US009866249B1

(12) **United States Patent**
Nagase et al.

(10) **Patent No.: US 9,866,249 B1**
(45) **Date of Patent: *Jan. 9, 2018**

(54) **CARD HOLDING MEMBER AND CARD CONNECTOR**

(71) Applicant: **Molex, LLC**, Lisle, IL (US)

(72) Inventors: **Teruki Nagase**, Yamato (JP); **Akihiro Shimotsu**, Ebina (JP)

(73) Assignee: **Molex, LLC**, Lisle, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **15/683,168**

(22) Filed: **Aug. 22, 2017**

Related U.S. Application Data

(63) Continuation of application No. 14/950,077, filed on Nov. 24, 2015, now Pat. No. 9,774,359.

(30) **Foreign Application Priority Data**

Dec. 3, 2014 (JP) 2014-244791

(51) **Int. Cl.**
H01R 24/00 (2011.01)
H04B 1/3816 (2015.01)

(52) **U.S. Cl.**
CPC ***H04B 1/3816*** (2013.01)

(58) **Field of Classification Search**
CPC H01R 27/00; H01R 13/635; H01R 13/633
USPC 439/630, 19
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,602,096	B1	8/2003	Kronestedt et al.	
7,059,911	B2	6/2006	Uchida et al.	
2006/0040560	A1 *	2/2006	Uchida	H01R 13/24 439/630
2012/0276780	A1 *	11/2012	Hu	H01R 12/714 439/630
2016/0164225	A1 *	6/2016	Nagase	H04B 1/3816 439/159

FOREIGN PATENT DOCUMENTS

CN 202178465 U 3/2012

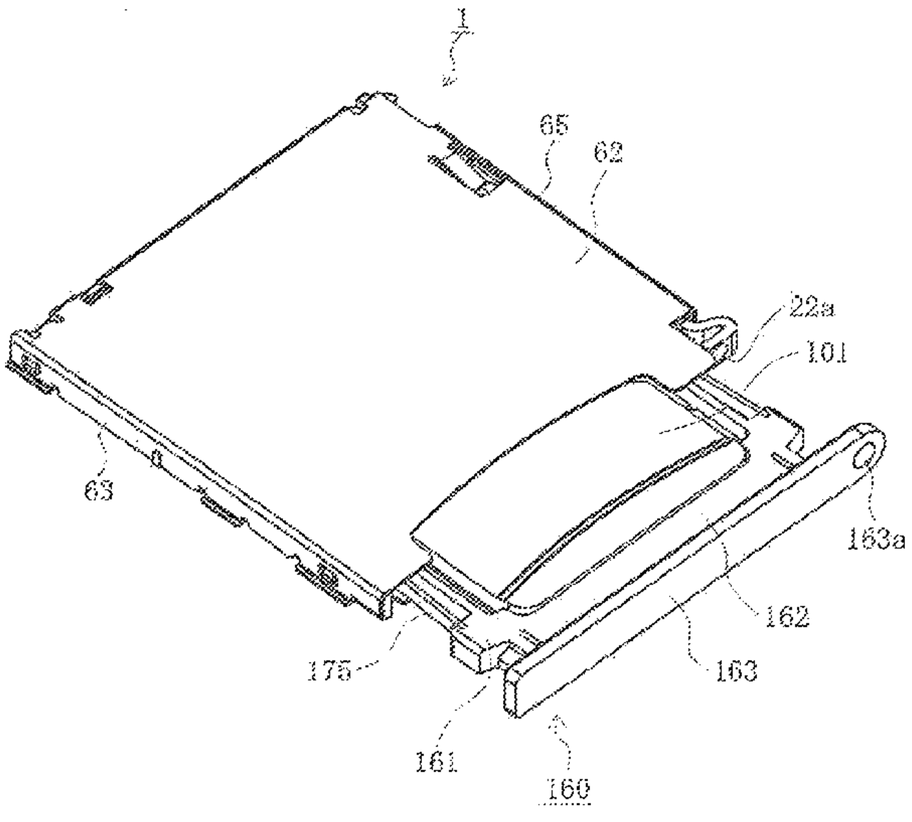
* cited by examiner

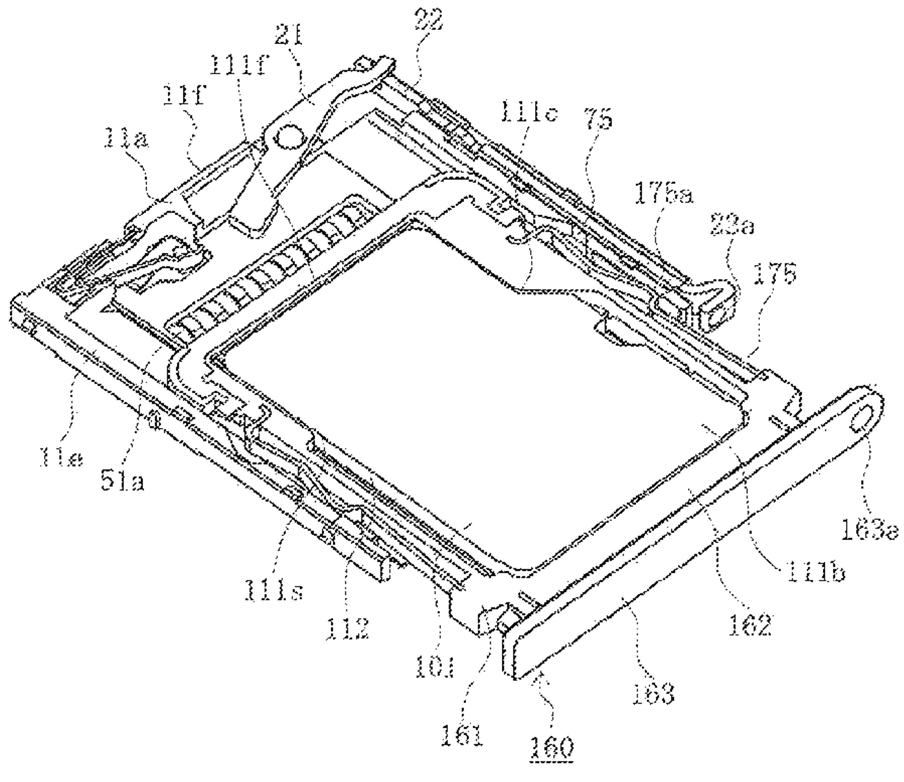
Primary Examiner — Phuong Chi T Nguyen
(74) *Attorney, Agent, or Firm* — James A. O'Malley

(57) **ABSTRACT**

The card holding member is able to hold a card including terminal members and is able to be inserted into a card connector, and comprises a frame portion opposing the side surfaces of the card, and a movable lock portion arranged in the frame portion which is able to engage and disengage from a lock portion of the card connector, the movable lock portion being a spring member made of a metal plate and including at least one corner portion, and the movable lock portion also being elastically deformable in the width direction of the card holding member.

8 Claims, 7 Drawing Sheets





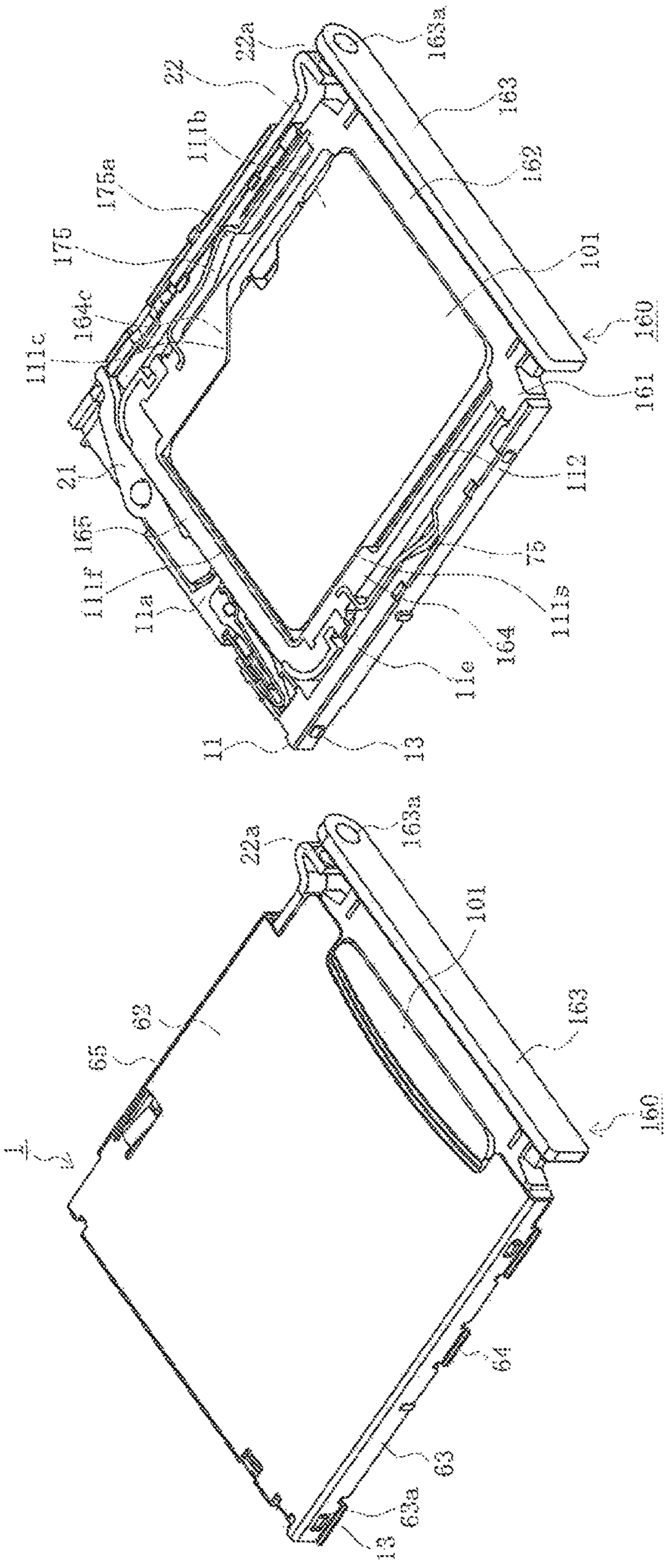

22
22a
163a
163
162
101
160
161
112
75
111s
164
11e
13
11
111b
175a
175
164c
111c
21
165
111f
11a
63a
63
64
65
62
1

FIG. 1a

FIG. 1b

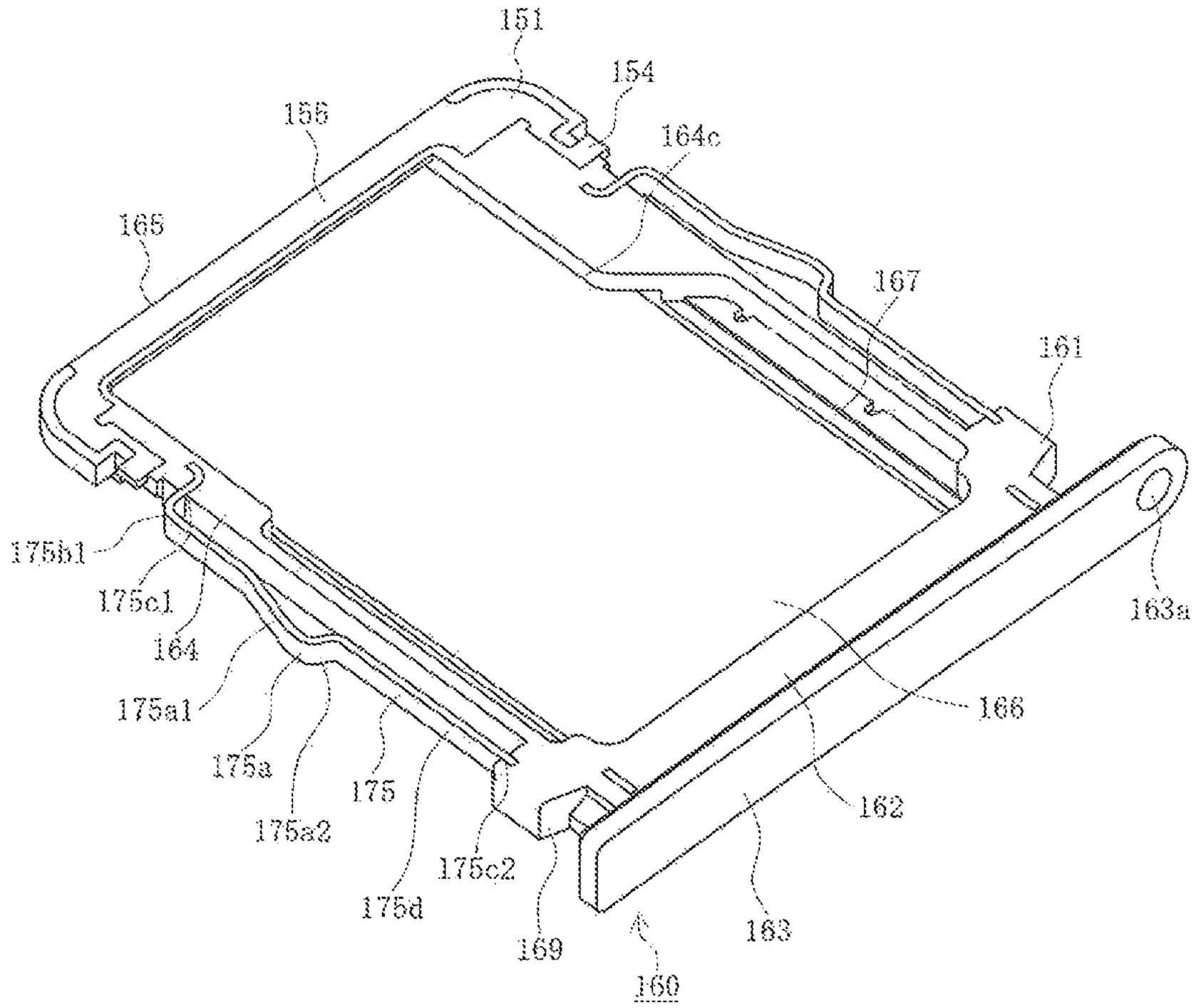

151
154
156
164c
165
167
161
175b1
175c1
164
163a
175a1
166
175a
175
162
175a2
175c2
175d
169
163
160

FIG. 2

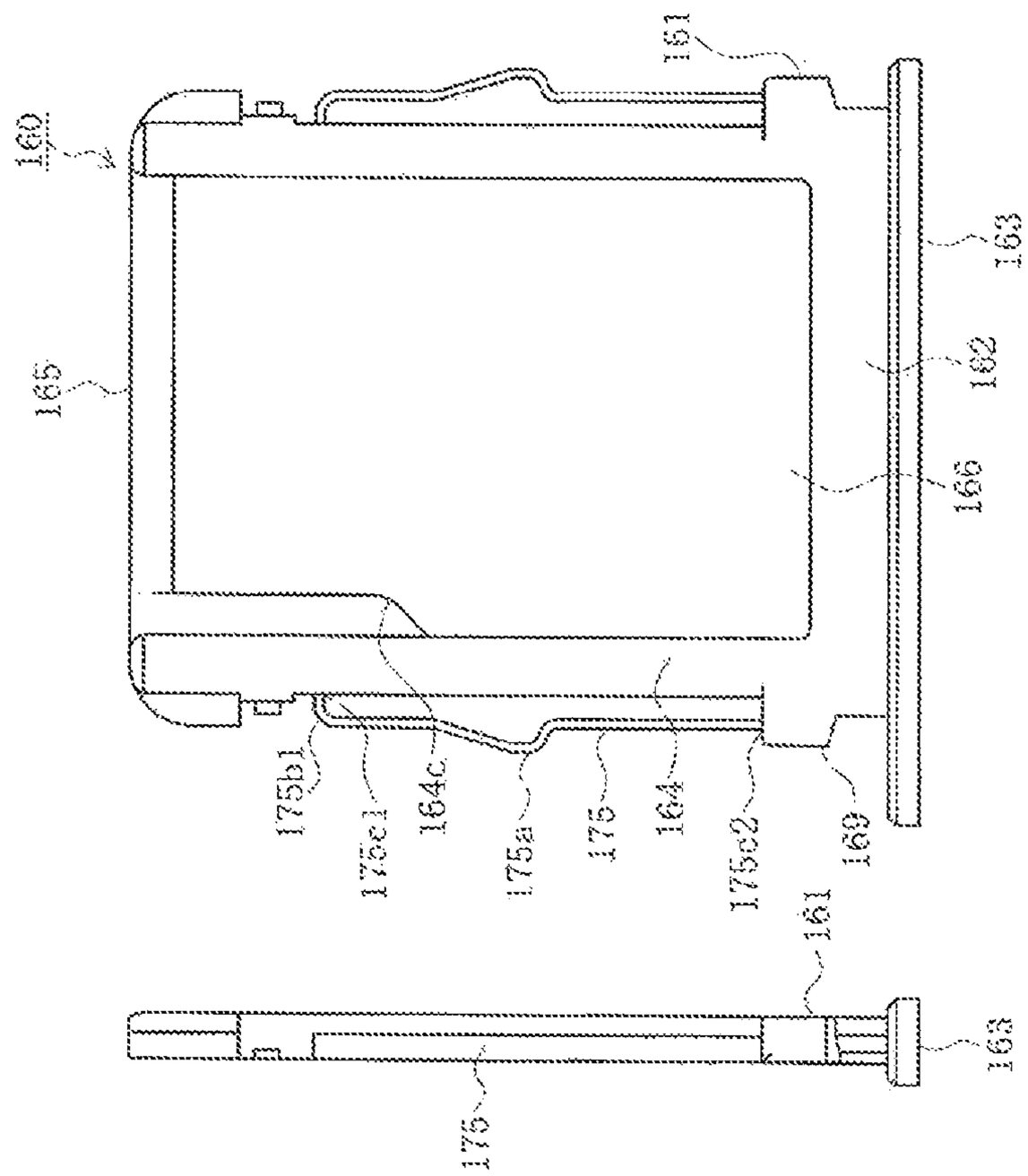


FIG. 3e

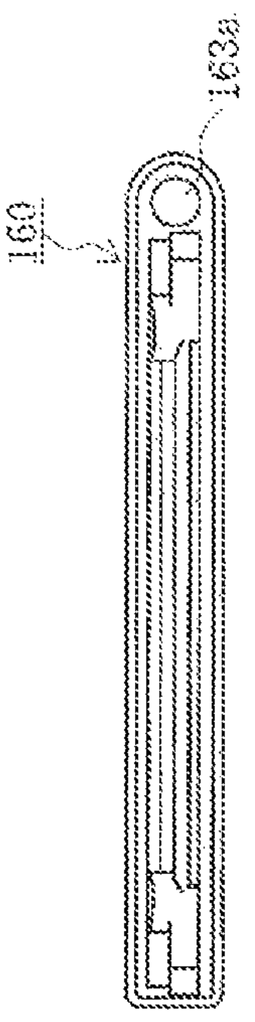


FIG. 3a

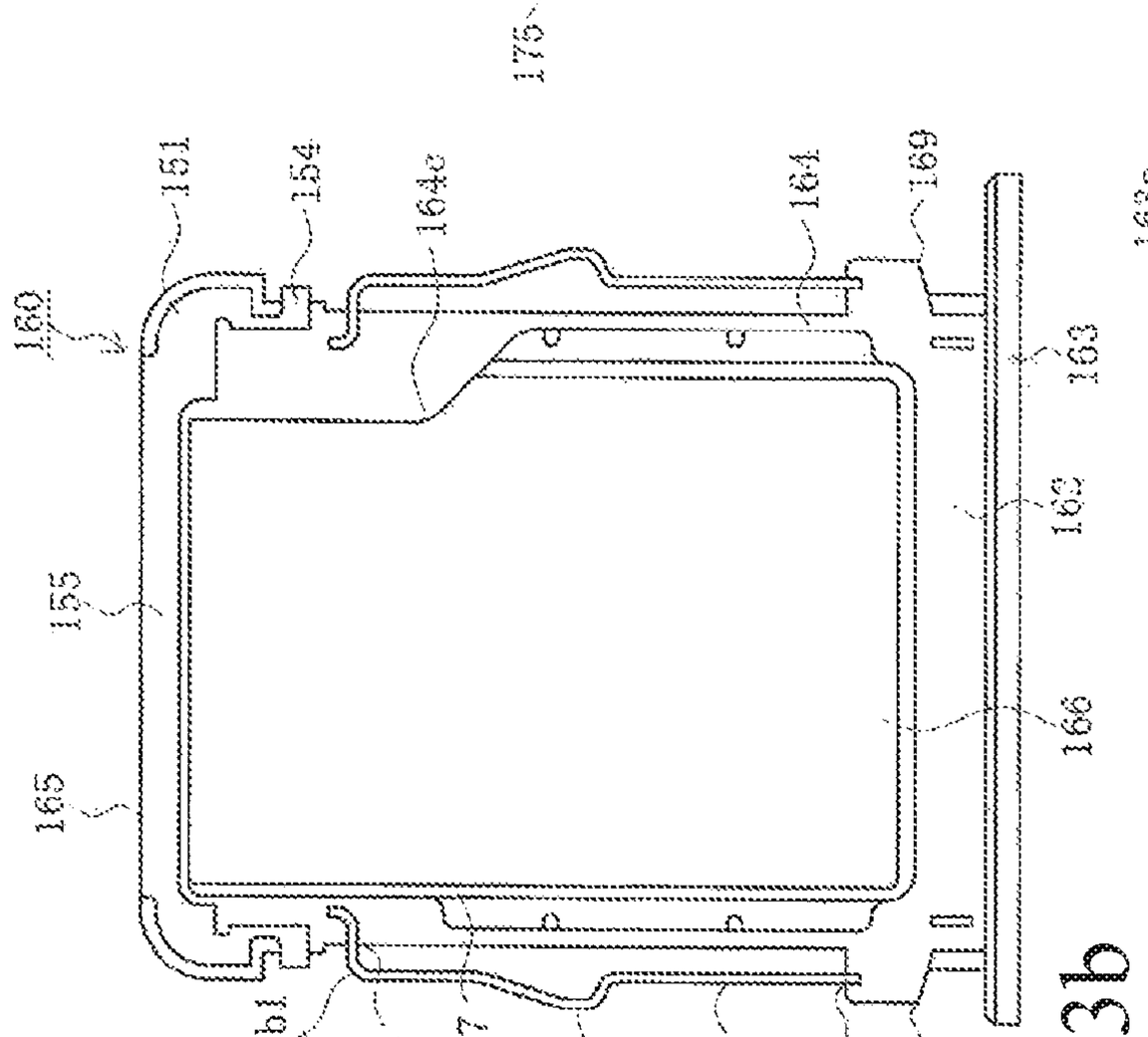


FIG. 3b

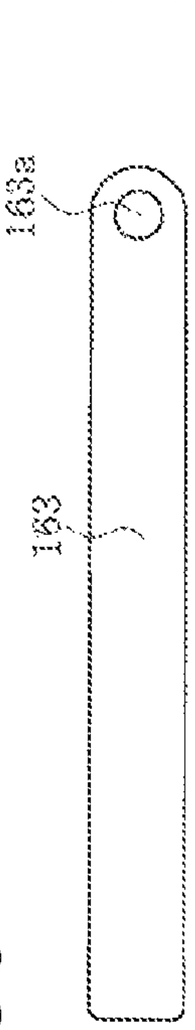


FIG. 3c

FIG. 3d

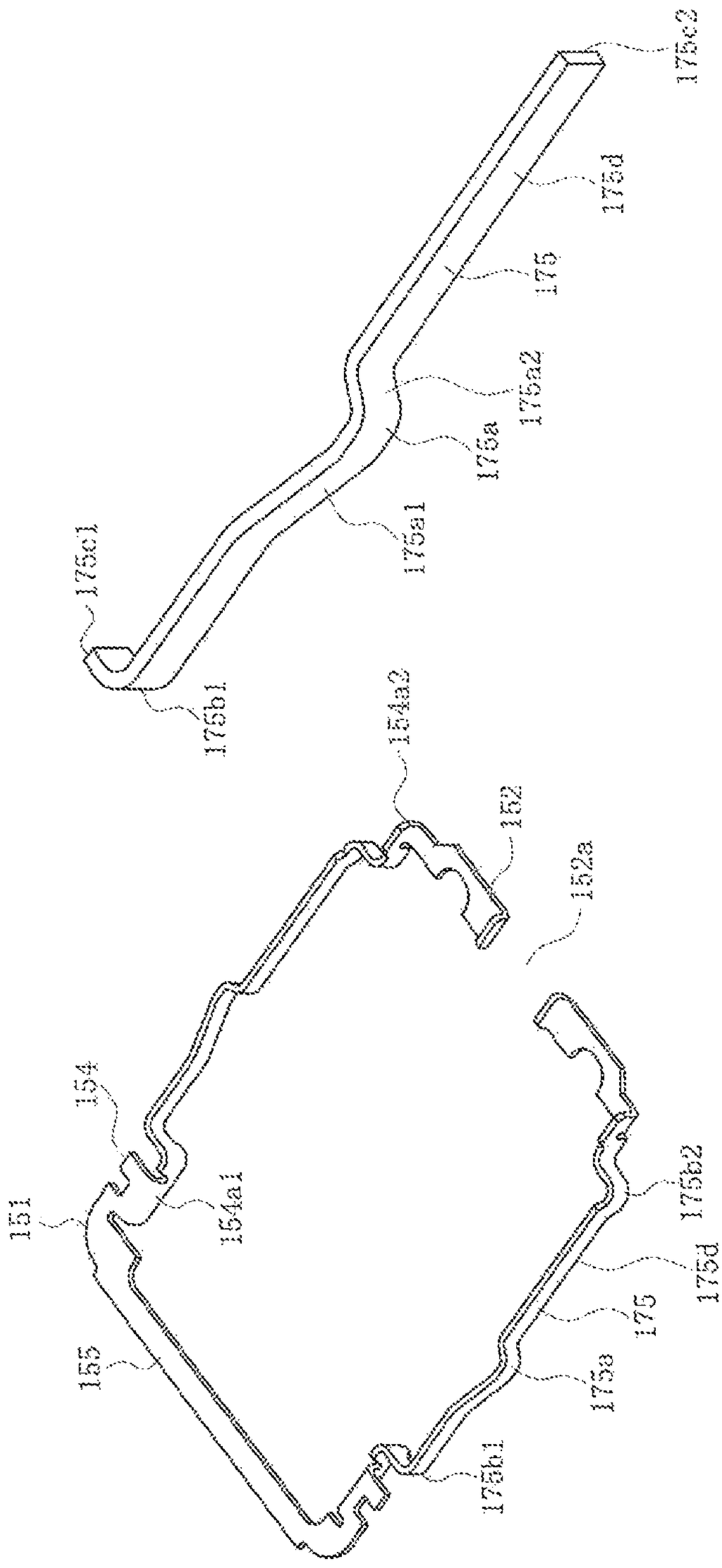

175c2
175d
175
175a2
175a
175a1
175c1
175b1
154a2
152
152a
154
151
154a1
155
175b2
175d
175
175a
175b1

FIG. 4b

FIG. 4a

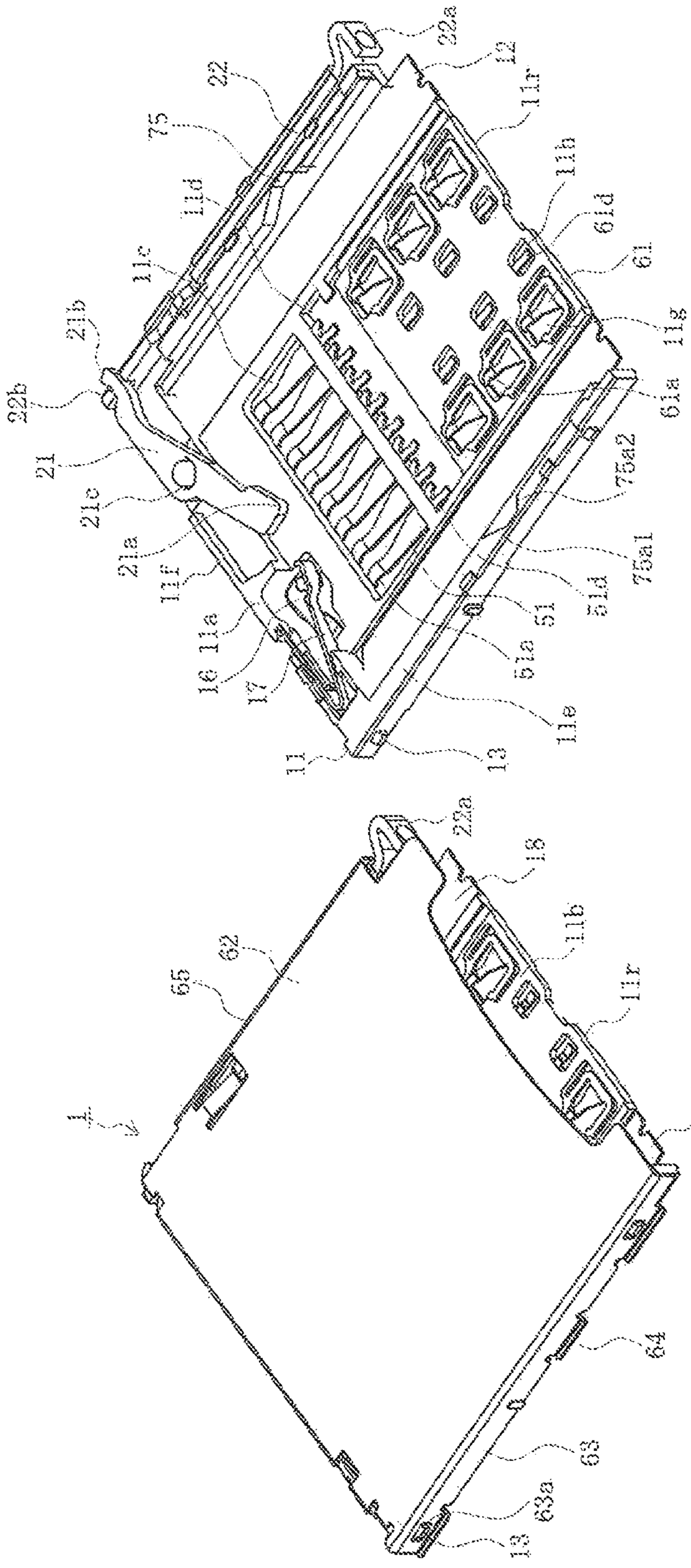

22a
12
11r
22
75
11h
11d
61d
11c
61
21b
11g
22b
61a
21
75a2
21c
21a
75a1
11f
61d
51
16
11a
61a
17
11e
11
13
22a
18
65
62
11b
11r
1
12
64
63
63a
13

FIG. 5b

FIG. 5a

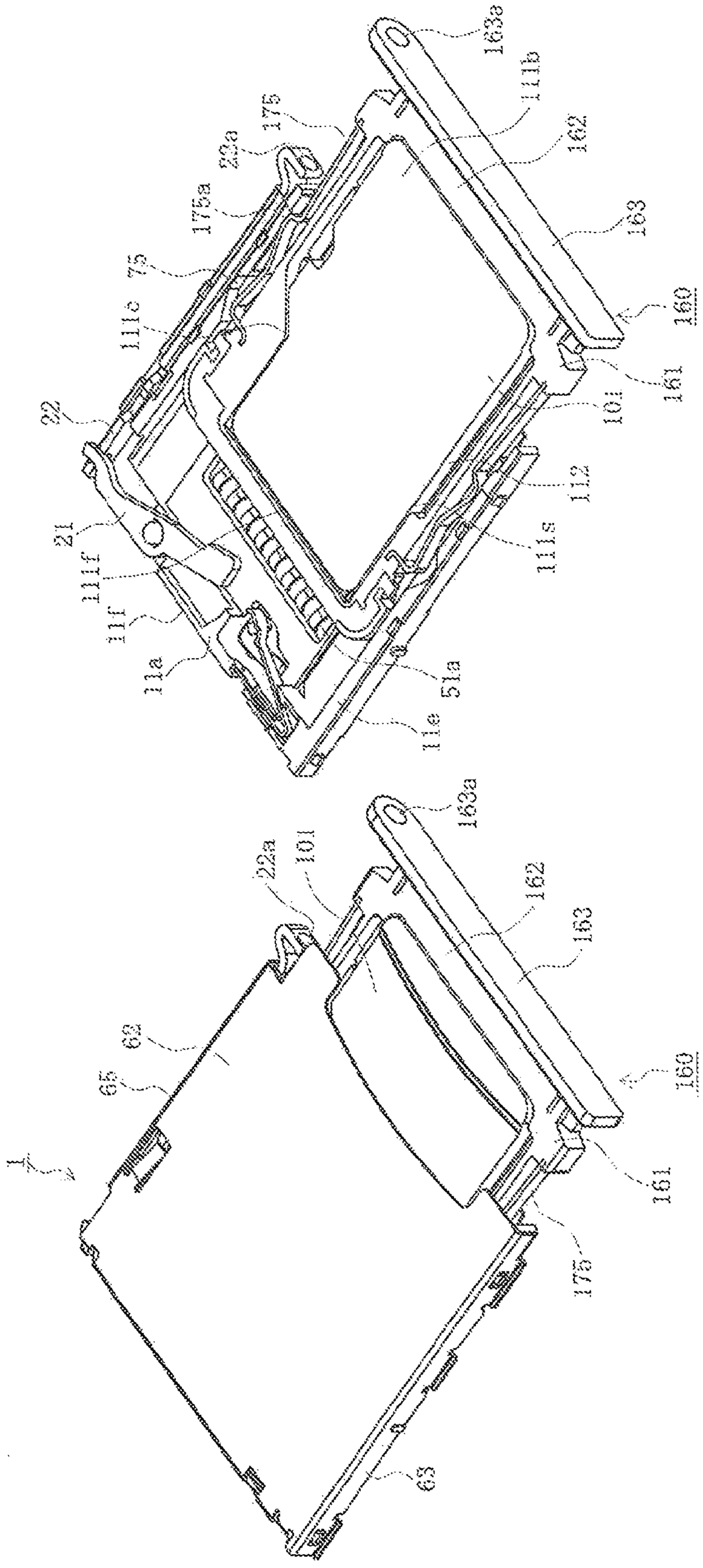
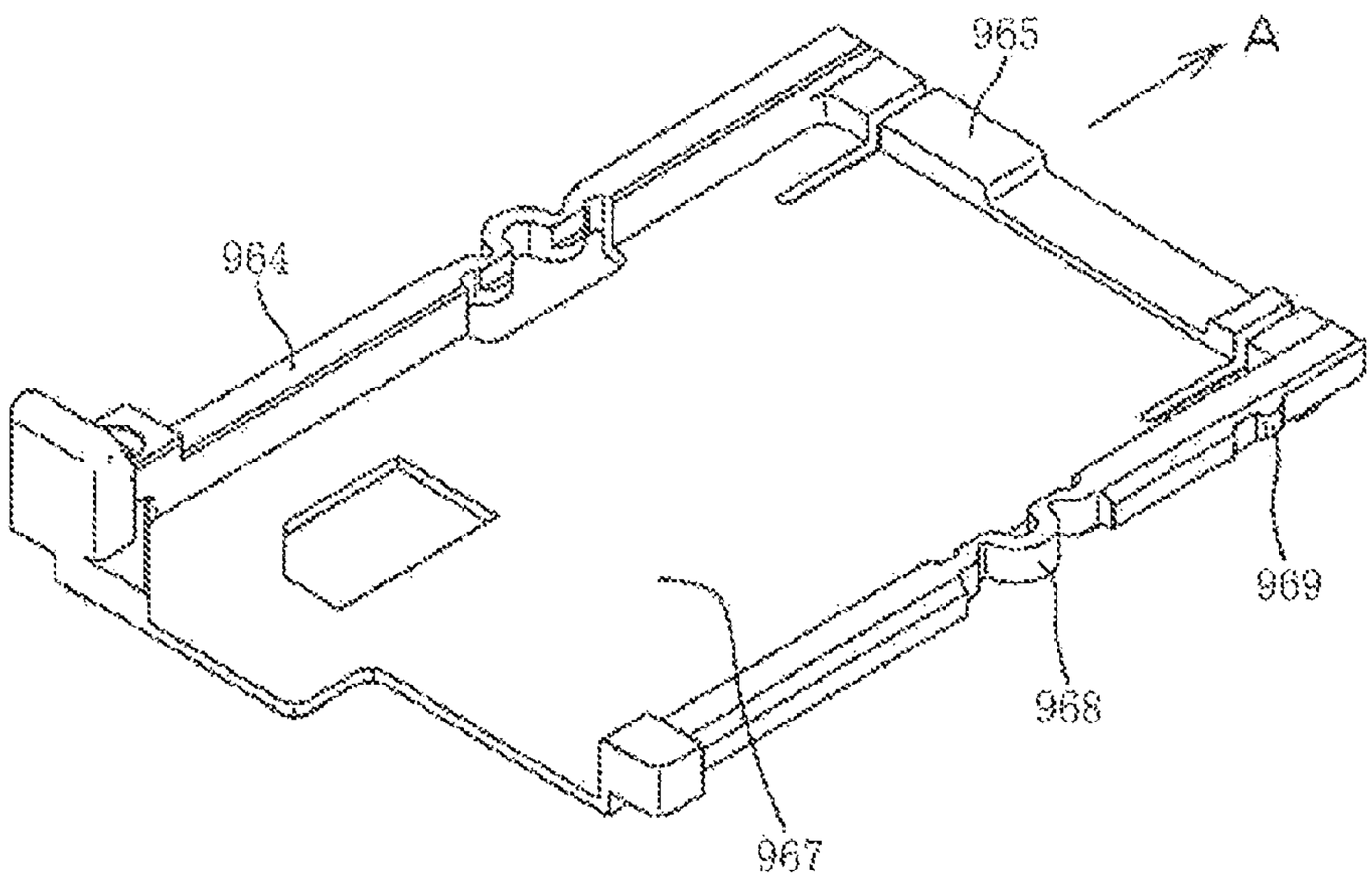

163a
111b
162
163
160
161
101
112
111s
51a
11e
11a
11f
111f
21
22
111e
75
175a
22a
175
63a
65
63
175

FIG. 6b

FIG. 6a



Prior art

FIG. 7

CARD HOLDING MEMBER AND CARD CONNECTOR

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 14/950,077, filed Nov. 24, 2015, which, in turn, claims priority to Japanese Application No. 2014-244791, filed Dec. 3, 2014. Each of these applications are incorporated herein by reference in their entireties.

TECHNICAL FIELD

The present disclosure relates to a card holding member and to a card connector.

BACKGROUND ART

Electronic devices such as mobile phones include a card connector enabling the use of various types of cards such as SIM (Subscriber Identity Module) cards.

Electronic devices have become significantly smaller in recent years, and so have cards and card connectors. As a result, it can be difficult for users to grasp a card with the fingers and insert the card properly into a card connector. Therefore, card connectors have been proposed in which a card is set inside a card holder and the card holder is inserted into the card connector (see, for example, Patent Document 1).

FIG. **7** is a perspective view of a card tray of the prior art.

In this drawing, **967** denotes a bottom panel of a card tray made of a resin material, **964** denotes the pair of side walls, and **965** denotes the front wall. The card tray is moved in the direction indicated by arrow A with a card (not shown) housed inside the recessed portion defined by the bottom panel **967**, the side walls **964**, and the front wall **965**.

A contact piece **968** is formed in the middle of each side wall **964** which bulges to form a semicircular profile, and a protrusion-shaped engaging portion **969** is formed near the front end of each side wall portion **964**. When the card tray is inserted into the card connector, the contact pieces **968** make elastic contact with and slide along left and right guide walls inside the card connector to keep the card tray stable in the transverse direction. The engaging portions **969** are prevented from passing the inner lock portions on the guide walls.

[Patent Document 1] Laid-Open Patent Publication No. 2006-059660

SUMMARY OF THE INVENTION

However, the card tray of the prior art is only held inside the card connector by the engaging portions **969** preventing the card tray from passing the inner lock portions on the guide walls in the card connector. As a result, the retention force is weak and the card tray may become detached from the card connector during use. Also, because the contact pieces **968** only make elastic contact with the guide walls in the card connector, they do not reliably hold the card tray inside the card connector.

It is an object of the present disclosure to solve this problem by providing a highly reliable card holding member that can be easily inserted into a card connector and reliably held by the card connector, and a card connector for the card holding member.

The present disclosure is a card holding member able to hold a card including terminal members and able to be inserted into a card connector, the card holding member comprising a frame portion opposing the side surfaces of the card, and a movable lock portion arranged in the frame portion able to engage and disengage from a lock portion of the card connector, the movable lock portion being a spring member made of a metal plate and including at least one corner portion, and the movable lock portion also being elastically deformable in the width direction of the card holding member.

In another aspect of the card holding member of the present disclosure, the movable lock portion is a band-like member fixed to the frame portion at both ends and including a main body portion extending linearly, and an engaging portion formed in the middle of the main body portion and able to engage the lock portion, the corner portion being connected to at least one end of the main body portion.

In another aspect of the card holding member of the present disclosure, the corner portion is a portion of a metal plate bent from the longitudinal direction of the card holding member to a direction intersecting the longitudinal direction.

In another aspect of the card holding member of the present disclosure, the engaging portion includes a front inclined surface and a rear inclined surface formed in front of and behind an apex point, the engaging portion being a protruding portion bulging outwardly in the transverse direction of the card holding member, and the lock portion being a recessed portion including a front inclined surface and a rear inclined surface.

In another aspect of the card holding member of the present disclosure, the corner portion is connected only to the front end of the main body portion, the rear end of the main body portion being secured to the frame portion.

The present disclosure is also a card connector able to receive any one of the inserted card holding members described above, the card connector including a lock portion able to engage and disengage from the movable lock portion.

In another aspect of the card connector of the present disclosure, the card connector may include an ejection mechanism for ejecting the card holding member.

The present disclosure is able to provide a highly reliable card holding member that can be easily inserted into a card connector and reliably held by the card connector.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**(*a*) is a perspective view of a card tray inserted into a card connector according to an embodiment of the present disclosure, in which the shell is attached.

FIG. **1**(*b*) is a perspective view of the card tray of FIG. **1**(*a*) with the shell removed.

FIG. **2** is a perspective view of the card tray according to an embodiment of the present disclosure.

FIG. **3**(*a*) is a front view of the card tray according to an embodiment of the present disclosure.

FIG. **3**(*b*) is a top view of the card tray of FIG. **3**(*a*).

FIG. **3**(*c*) is a rear view of the card tray of FIG. **3**(*a*).

FIG. **3**(*d*) is a side view of the card tray of FIG. **3**(*a*).

FIG. **3**(*e*) is a bottom view of the card tray of FIG. **3**(*a*).

FIG. **4**(*a*) is a perspective view of the metal portion of the entire card tray in an embodiment of the present disclosure.

FIG. **4**(*b*) is a perspective view of an enlarged view of a portion of the metal portion of the entire card tray of FIG. **4**(*a*).

FIG. **5**(*a*) is a perspective view of a card connector according to an embodiment of the present disclosure, in which the shell is attached.

FIG. **5**(*b*) is a perspective view of the card connector of FIG. **5**(*a*) with the shell removed.

FIG. **6**(*a*) is a perspective view of a card tray being inserted into a card connector according to an embodiment of the present disclosure, in which the shell is attached.

FIG. **6**(*b*) is a perspective view of the card tray of FIG. **6**(*a*) with the shell removed.

FIG. **7** is a perspective view of a card tray of the prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following is a detailed explanation of an embodiment of the present disclosure with reference to the drawings.

FIGS. **1**(*a*) and **1**(*b*) are a pair of perspective views of a card tray inserted into a card connector according to an embodiment of the present disclosure. FIG. **2** is a perspective view of the card tray according to an embodiment of the present disclosure. FIGS. **3**(*a*), **3**(*b*), **3**(*c*), **3**(*d*), **3**(*e*) are a set of five views of the card tray according to an embodiment of the present disclosure, FIGS. **4**(*a*) and **4**(*b*) are a pair of perspective views of the metal portion of the card tray in an embodiment of the present disclosure. FIGS. **5**(*a*) and **5**(*b*) are a pair of perspective views of a card connector according to an embodiment of the present disclosure.

In the drawings, **160** is the card tray serving as the card holding member in the present embodiment. As shown in FIG. **1**(*a*), the card tray **160** is inserted into a card connector **1** mounted in an electronic device (not shown) while housing a card **101**. In other words, a card **101** is accommodated inside the card tray **160** with both side surfaces **112** surrounded by the frame portion **161** facing the side surfaces **112**, and is mounted in an electronic device via a card connector **1**. The electronic device may be any type of device, including a personal computer, a mobile phone, a smartphone, a communication modem, a tablet, a digital camera, a video camera, a music player, a gaming console, or a car navigation system.

However, when a card connector other than card connector **1** is mounted in an electronic device, the user sometimes does not use the card connector **1**. In this case, the user can insert the empty card tray **160**, that is, the card tray **160** not housing a card **101**, into the card connector **1** for storage.

The card **101** can be any type of card such as a SIM card, microSIM card, nanoSIM card, MMC® (Multi Media) card, SD® (Secure Digital) card, miniSD® card, xD-Picture® card, Memory Stick®, Memory Stick Duo®, Smart Media®, or TransFlash® memory card. In the present embodiment, the card is a microSD® card.

In the present embodiment, as shown in FIG. **1**(*b*), the card **101** has a substantially rectangular band-like shape, and electrode pads serving as the terminal members (not shown) are arranged in rows along the front end **111***f* on one surface (the lower surface in the example shown in the drawing). Electrode pads are not provided on the other surface, that is, on the upper surface **111***b* opposite the lower surface. A notched portion **111***c* is formed in one of the corners connecting the left and right ends of the front end **111***f* to the side ends **111***s*. More specifically, this notched portion is formed in the front right corner of the upper surface **111***b*. The notched portion **111***c* is formed by cutting away one of the corners where the front end **111***f* of the card **101** is connected to a side end **111***s* so as to form a truncated triangle.

In the present embodiment, the expressions indicating direction, such as upper, lower, left, right, front and rear, which are used to explain the configuration and operation of each portion of the card connector **1**, card tray **160**, and card **101**, are relative and not absolute. They depend on the orientation of the connector **1**, card tray **160**, and card **101**, and their constituent components shown in the drawings. When the orientation of the connector **1**, card tray **160**, and card **101** or their constituent components changes, the interpretation changes in response to the change in orientation.

Here, the card tray **160** includes a metal portion **151** integrally formed by stamping and bending a metal plate, and a resin portion **169** made of an insulating resin covering and becoming integrated with a portion of the metal portion **151** using a molding technique such as insert molding or overmolding.

The frame portion **161** of the card tray **160** is a rectangular frame member surrounding all four sides of a space **166** serving as the card accommodating space for accommodating a card **101**. The frame portion **161** has a rear frame portion **162** and a front frame portion **165** extending parallel to each other in the transverse direction. The frame portion **161** also has a pair of side frame portions **164** extending in the longitudinal direction and connected to both ends of the rear frame portion **162** and the front frame portion **165**.

A protruding portion **164***c* is formed in a corner, more specifically, the front right corner, where one of the side frame portions **164** is connected to the front frame portion **165**. The protruding portion **164***c* functions as a card orientation restricting portion. As shown in the drawing, when the card **101** has the proper orientation, the card **101** is allowed to be housed inside the card tray **160**. However, when the card **101** does not have the proper orientation, the card **101** is not allowed to be housed inside the card tray **160**. In other words, the card **101** cannot be housed inside the space **166**. More specifically, the protruding portion **164***c* has a truncated triangle profile and is formed in a way to correspond to the notched portion **111***c* of the card **101** housed inside the space **166** in the proper orientation. As a result, a card **101** cannot be inserted into and housed in the space **166** inside the card tray **160** when oriented improperly, that is, when inserted upside-down or backwards.

A rear panel portion **163** is connected to the rear of the rear frame portion **162**. A through-hole **163***a* is formed at one end of the rear panel portion **163** and passes through the rear panel portion **163** in the thickness direction. The through-hole **163***a* allows an auxiliary member such as a pin or rod to be inserted in order to apply pressure and operate the operating portion **22***a* of the push rod **22** in the card connector **1**.

The upper surfaces of the rear frame portion **162**, the side frame portion **164**, and the front frame portion **165**, excluding the rear side portion **163**, are flush. However, the lower surface of the front frame portion **165** is preferably higher than the lower surface of the side frame portions **164**. The lower surface of the front frame portion **165** is also preferably higher than the lower surface of a card **101** held inside the space **166**. In this way, the front frame portion **165** does not make contact with the primary terminals **51** and secondary terminals **61** when the card tray **160** is inserted into the card connector **1**.

Eaves portions **167** extend into the space **166** from the inner lower ends of the rear frame portion **162** and the left and right side frame portions **164**. The eaves portions **167** function as card support portions for supporting at least some of the lower surface of the card **101** held inside the space **166**, for example, near the side ends.

The side surfaces of the front frame portion **165**, the rear frame portion **162**, and the side frame portions **164** facing the space **166**, that is, the inside surfaces, are all coated with

an insulating resin so that the metal portion **151** is not exposed. Therefore, even though the peripheral edges of the electrode pads arranged on the lower surface of the card **101** housed inside the space **166** are exposed on the side surfaces **112** of the card **101**, they do not come into contact with the metal portion **151**.

As shown in FIG. **4**(*a*), the metal portion **151** is a frame member with a substantially rectangular profile, and includes a rear metal frame portion **152** and a front metal frame portion **155** extending in the transverse direction substantially parallel to each other, and a pair of metal side frame portions **154** extending on the longitudinal direction and connecting both ends of the rear metal frame portion **152** to both ends of the front metal frame portion **155**. In the example shown in the drawing, the rear metal frame portion **152** includes a cutaway portion **152***a* in the middle dividing the section to the right and left. However, the section without the cutaway portion **152***a* is a single continuous body.

In the present embodiment, each metal side frame portion **154** includes a lock spring portion **175** in the middle, which is a movable lock portion for holding the card tray **160** inserted into the card connector **1**. The lock spring portions **175** function as plate springs elastically displaced in the transverse direction of the card tray **160**. Therefore, these plate-like members extend in the thickness direction (vertical direction) of the card tray **160**. As in the case of the rear metal frame portion **152** and the front metal frame portion **155**, the other portions of the metal side frame portions **154** are plate-like members extending parallel to the upper surface or the lower surface of the card tray **160**. As a result, the longitudinal ends of the lock spring portions **175** are connected to the other portions of the metal side frame portions **154**. In the explanation of the present embodiment, the front bent portion **154***a***1** and the rear bent portion **154***a***2** are sometimes referred to collectively as the bent portions **154***a*.

The lock spring portions **175** are slender band-like members with spring action extending in the thickness direction of the card tray **160** and extending in the longitudinal direction of the card tray **160**. They include a plate-like main body portion **175***d* exposed to the outside of the side frame portion **164**, extending linearly in the longitudinal direction of the card tray **160**, and fixed at both ends to the side frame portion **164** to function as a beam. Before the metal portion **151** has been integrated with the resin portion **169**, the lock spring portions **175**, as shown in FIG. **4** (*a*), include a front corner portion **175***b***1** connected to the front end of the main body portion **175***d* and a rear corner portion **175***b***2** connected to the rear end of the main body portion **175***d*. The front corner portion **175***b***1** and the rear corner portion **175***b***2** are preferably bent from the longitudinal direction of the card tray **160** to a direction intersecting the longitudinal direction, preferably at a 90-degree angle. In the following explanation, these components are sometimes referred to collectively as the corner portions **175***b*. The lock spring portions **175** functioning as beam-like plate springs include a front corner portion **175***b***1** and a rear corner portion **175***b***2** connected at both ends to the main body portion **175***d*. This increases the flexibility and amount of elastic displacement. In order to adjust the amount of elastic displacement, either the front corner portion **175***b***1** or the rear corner portion **175***b***2** can be omitted.

In the example shown in the drawings, the rear corner portion **175***b***2** is embedded in the resin portion **169** near the rear end of the side frame portion **164**. Therefore, in the lock spring portions **175** of the example shown in the drawings, the front fixed portion **175***c***1** fixed to the side frame portion **164** is the front end and the rear fixed portion **175***c***2** fixed to the side frame portion **164** is the rear end. In other words, the lock spring portions **175** only include the front corner portion **175***b***1** in the section exposed to the outside of the side frame portion **164** from the front fixed portion **175***c***1** to the rear fixed portion **175***c***2**. FIG. **4**(*b*) shows the lock spring portion **175** from the front fixed portion **175***c***1** at the front end to the rear fixed portion **175***c***2** at the rear end. The rear fixed portion **175***c***2** is the main body portion **175***d*.

The lock spring portion **175** includes a lock protruding portion **175***a* in the middle, which is an engaging portion elastically displaced inward in the transverse direction of the card tray **160**. The lock protruding portion **175***a* is a protruding portion bulging outward in the transverse direction of the card tray **160**, and includes a gently sloping front inclined surface **175***a***1** and a sharply sloping rear inclined surface **175***a***2** near the apex. When the card tray **160** has been completely inserted into the card connector **1**, the lock protruding portions **175***a* are engaged in the lock recessed portions **75** serving as the lock portions on the card connector **1**.

In the present embodiment, as shown in FIG. **5**(*a*), the card connector **1** has a housing **11** integrally molded from an insulating material such as a synthetic resin, and a shell **65** or cover member formed integrally by punching and bending a conductive metal sheet which is attached to the upper side of the housing **11**. The shell **65** has a substantially rectangular ceiling panel portion **62** and side panel portions **63** erected on the side edges of the ceiling panel portion **62**, and covers the housing **11** and at least some of the upper portion of the card tray **160** inserted into the housing **11** and the card connector **1**. The card connector **1** has a substantially parallelepiped shape, and is mounted on the surface of a board such as a printed circuit board in the electronic device. A card tray **160** is inserted into the insertion slot **18** in the rear (below right in FIG. **5**(*a*)). More specifically, the card tray **160** is inserted into the card insertion space between the housing **11** and the shell **65**.

The housing **11** includes primary terminals **51**, secondary terminals **61**, and a lower shell **12** integrally formed by stamping and bending a metal plate. This substantially plate-like member is integrally molded using a molding technique such as insert molding or overmolding with an insulating resin which covers and becomes integrated with at least a portion of the primary terminals **51**, secondary terminals **61**, and lower shell **12**. The lower shell **12** is a frame member for reinforcing the housing **11**, and is preferably formed from the same material as the primary terminals **51** and/or secondary terminals **61**, but is electrically insulated from the primary terminals **51** and the secondary terminals **61**.

The housing **11** also includes a bottom wall portion **11***b* serving as the substantially rectangular, plate-like terminal holding portion, an inner wall portion **11***a* thicker than the bottom wall portion **11***b* which extends in the transverse direction of the housing **11** along the front end portion **11***f* in the insertion direction (longitudinal direction) of the card tray **160**, and a pair of side wall portions **11***e* thicker than the bottom wall portion **11***b* extending in the insertion direction of the housing **11** along both side edges. The lower surfaces of the inner wall portion **11***a* and the side wall portions **11***e* are flush with the lower surface of the bottom wall portion **11***b*, and the upper surfaces are above the upper surface of the bottom wall portion **11***b*. The end portion of the housing **11** in the insertion direction of the card tray **160** is referred to as the rear end portion **11***r*.

Here, the bottom wall portion **11***b* includes a primary terminal holding recessed portion **11***c* and secondary terminal holding recessed portions **11***g* for holding the exposed portions of the primary terminals **51** and the secondary terminals **61**, as well as a primary terminal solder tail opening **11***d* and secondary terminal solder tail openings **11***h*. The primary terminal holding recessed portion **11***c*, secondary terminal holding recessed portions **11***g*, primary terminal solder tail opening **11***d*, and secondary terminal solder tail openings **11***h* are openings which pass through the bottom wall portion **11***b* in the thickness direction.

There is a single primary terminal holding recessed portion **11***c* and primary terminal solder tail opening **11***d*, and a single row of primary terminals **51** extending in the transverse direction of the housing **11** is arranged inside. At least a portion of the primary terminals **51** is embedded in the bottom wall portion **11***b*, and at least the contact portion **51***a* is exposed inside the primary terminal holding recessed portion **11***c*. The solder tail portion **51***d* of each terminal to be soldered is also exposed inside the primary terminal solder tail opening **11***d*. The contact portion **51***a* of each primary terminal **51** is biased upwards by the spring action of the arm portion, and comes into contact with the corresponding electrode pad on the card **101** inside the card tray **160** held inside the card connector **1**. Each solder tail portion **51***d* is connected electrically by solder to a signal line, contact pad, or terminal formed on a printed circuit board.

The secondary terminal holding recessed portions **11***g* and the secondary terminal solder tail openings **11***h* are arranged side by side to form rows extending in the longitudinal direction of the housing **11**. In the example shown in the drawing, there are two rows of three. At least a portion of each secondary terminal **61** is embedded in the bottom wall portion **11***b*, and at least a contact portion **61***a* is exposed inside each secondary terminal holding recessed portion **11***g*. A solder tail portion **61***d* to be soldered is exposed in each secondary terminal solder tail opening **11***h*. Therefore, the secondary terminals **61** held in each secondary terminal holding recessed portion **11***g* are arranged in two rows extending in the longitudinal direction of the housing **11**. At least a portion of each secondary terminal **61** is embedded in the bottom wall portion **11***b*, and at least the contact portion **61***a* is exposed inside a secondary terminal holding recessed portion **11***g*. The contact portion **61***a* of each secondary terminal **61** is biased upwards by the spring action of the arm portion, and comes into contact with the corresponding electrode pad on the card **101** inside the card tray **160** held inside the card connector **1**. Each solder tail portion **61***d* is connected electrically by solder to a signal line, contact pad, or terminal formed on a printed circuit board.

The primary terminals **51** are arranged so as to match the electrode pads on a microSD® card, and the secondary terminals **61** are arranged so as to match the electrode pads on a nanoSIM® card. In other words, the card connector **1** can accommodate different types of cards **101** housed in the card tray **160**. For example, it can accommodate a card **101** that is a microSD® card or a nanoSIM® card. The number and arrangement of primary terminals **51** and secondary terminals **61** can be changed if necessary to conform to the number and arrangement of electrode pads on a card **101**. When the card tray **160** can only accommodate a single type of card **101**, either the primary terminals **51** or the secondary terminals **61** can be omitted.

The lower shell **12** is exposed between the bottom wall portion **11***b* and the left and right side wall portions **11***e*. A lock recessed portion **75** is formed on the inner side surface of each side wall portion **11***e* to engage a lock protruding portion **175***a* formed in the lock spring portion **175** of the card tray **160** and to hold and secure the card tray **160**. Each lock recessed portion **75** is a recessed portion including a gradually sloping front inclined surface **75***a***1** and a sharply sloping rear inclined surface **75***a***2**.

A push rod **22** is slidably mounted in the longitudinal direction on the inside surface of one of the side wall portions **11***e*. This serves as the tray ejection operation member in the tray ejection mechanism for ejecting the card tray **160** inserted into the card connector **1**. The push rod **22** is a linear rod-shaped or band-shaped member, and a bent operating portion **22***a* is integrally connected to the rear end portion. An engaging portion **22***b* is formed in the front end portion of the push rod **22** to engage the force input portion **21***b* of the ejection lever **21**. The ejection lever **21** is a lever-shaped member arranged near the inner wall portion **11***a*, and functions as the tray ejection lever of the tray ejection mechanism. As a result, the ejection lever **21** is pivotally mounted on the bottom wall portion **11***b* at the fulcrum portion **21***c*. The end on the other side of the fulcrum portion **21***c* from the force input portion **21***b* functions as the force output portion **21***a* which comes into contact with the front frame portion **165** of the card tray **160** inserted into the card connector **1** and applies force to the card tray **160** in the direction of ejection.

The shell **65** has side panel portions **63** extending from the side edges of a ceiling panel portion **62**. A plurality of locking openings **63***a* are formed on the side panel portions **63**. When the shell **65** is mounted on the upper side of the housing **11**, the locking openings **63***a* are engaged by locking protrusions **13** formed on the outside surfaces of the side wall portions **11***e* of the housing **11**, and the shell **65** is secured on the housing **11**. Also, solder tail portions **64** are formed at any location on the lower end of the side panel portions **63**. These serve as board-connectors and stand erect from the side panel portions **63** and extend outward in the transverse direction of the shell **65**. The solder tail portions **64** are secured by soldering to anchoring pads formed on the surface of the board.

The housing **11** includes a movable member **17** and a fixed member **16** for a detection switch used to detect whether a card tray **160** inserted into the card connector **1** has reached a predetermined position inside the card connector **1** (the position at which the inserted card tray **160** is locked). When the card tray **160** has not reached the predetermined position, the movable member **17** and the fixed member **16** are separate, and the detection switch is not electrified or turned OFF. However, when the card tray **160** reaches the predetermined position, the movable member **17** presses against the front frame portion **165** of the card tray **160**, and the movable member **17** is displaced and comes into contact with the fixed member **16**. Because this electrifies or turns the detection switch ON, it is determined that the card tray **160** has reached the predetermined position.

The following is an explanation of the operations performed by a card connector **1** with the configuration described above. First, the operations performed to insert the card tray **160** will be explained.

FIGS. **6**(*a*) and **6**(*b*) are a pair of perspective views of a card tray being inserted into a card connector according to an embodiment of the present disclosure.

The user manually inserts a card tray **160** housing a card **101** into the insertion slot **18** in the rear of the card connector **1**. Here, the card tray **160** is inserted properly with the upper surface facing upwards towards the ceiling panel portion **62** of the shell **65**, the lower surface facing downwards towards the bottom wall portion **11***b* of the housing **11**, and the front

frame portion **165** facing the front end portion **11***f* of the housing **11**. As a result, the upper surface **111***b* of the card **101** housed inside the space **166** which does not include any electrode pads faces upwards, and the lower surface including electrode pads and exposed on the lower surface of the card tray **160** is facing downwards. The card tray **160** can be inserted into the card connector **1** and ejected from the card connector **1** whether the tray is housing a card **101** or not housing a card **101**. In the following explanation, the tray is housing a card **101**. As mentioned above, the card **101** is a microSD® card.

When the card tray **160** is inserted from the insertion slot **18** into the card insertion space formed between the housing **11** and the shell **65**, the card tray **160** advances into the card insertion space with the lower surfaces of the side frame portions **164** approaching or making contact with the upper surface of the lower shell **12**. Next, as shown in FIG. **6**(*b*), the lock protruding portions **175***a* of the lock spring portions **175** exposed on the outside of the side frame portions **164** of the card tray **160** make contact with the inner surface of the side wall portions **11***e* of the housing **11**, and are elastically displaced inward in the transverse direction of the card tray **160**.

Because the lock protruding portions **175***a* begin to be deformed when the front inclined surfaces **175***a***1** come into contact with the rear end portion **11***r* of the side wall portions **11***e*, the portion of the lock spring portions **175** in front of the lock protruding portions **175***a*, that is, the front half, is elastically deformed. Because the lock spring portions **175** include front corner portions **175***b***1** formed near the front end, the front half is very flexible (not too rigid). Therefore, when the lock protruding portions **175***a* come into contact with the inside surfaces of the side wall portions **11***e* and begin to be displaced, the rebound force of the spring action of the lock spring portions **175** is not too great, and the user can insert the card tray **160** smoothly without having to push in the card tray **160** with great force. When the card tray **160** advances towards the front end portion **11***f*, the lock protruding portions **175***a* slide over the inner surfaces of the side wall portions **11***e*.

Next, when the user pushes in the card tray **160**, as shown in FIG. **1**(*a*), the card tray **160** reaches the predetermined position inside the card connector **1**. At this time, the movable portion **17** is pushed by the front frame portion **165** and comes into contact with the fixed member **16**, turning the detection switch ON to indicate that the card tray **160** has reached the predetermined position inside the card connector **1**.

As the card tray **160** advances to the predetermined position inside the card connector **1**, the force output portion **21***a* of the ejection lever **21** is pushed by the front frame portion **165** and displaced further in the direction of the front end portion **11***f*. As a result, the force input portion **21***b* of the ejection lever **21** is displaced farther in the direction of the rear end portion **11***r*, and the push rod **22** slides to the position protruding farthest to the rear.

When the card tray **160** reaches the predetermined position inside the card connector **1**, the force output portion **21***a* of the ejection lever **21** is interfered with by the inner wall portion **11***a* of the housing **11** and cannot be displaced any further in the direction of the front end portion **11***f*. As a result, the card tray **160** cannot advance any further.

When the card tray **160** has reached the predetermined position inside the card connector **1**, the lock protruding portions **175***a* on the left and right lock spring portions **175** are biased by the spring action of the lock spring portions **175**, are elastically displaced outward in the transverse direction of the card tray **160**, and engage the lock recessed portions **75** formed on the inner surfaces of the side wall portions **11***e*. Here, front inclined surfaces **175***a***1** face front inclined surfaces **75***a***1**, and rear inclined surfaces **175***a***2** face rear inclined surfaces **75***a***2**. As a result, the card tray **160** is stably held and locked at the predetermined position, and is kept from becoming displaced from the predetermined position to the rear.

The card **101** housed inside the card tray **160** can exchange data along with the card tray **160** at the predetermined position using an arithmetic processing means in the electronic device mounted in the card connector **1**. When the card **101** is held in the predetermined position, the contact portions **51***a* of the primary terminals **51** make contact with the electrode pads on the card **101** and establish an electrical connection.

The following is an explanation of the operations performed to eject a card tray **160** from the card connector **1**.

First, the user manually inserts an auxiliary member such as a pin or rod into the through-hole **163***a* formed in the rear panel portion **163** from the rear of the card tray **160**, and the tip of the auxiliary member is brought into contact with the operating portion **22***a* of the push rod **22**. When the user pushes in the push rod **22** via the auxiliary member, the force input portion **21***b* of the ejection lever **21** engaging the engaging portion **22***b* of the push rod **22** is displaced forward. As a result, the front frame portion **165** is pressed against the force output portion **21***a* of the ejection lever **21**, the card tray **160** moves to the rear from the predetermined position, the detection switch turns OFF, and movement of the card tray **160** to the rear of the predetermined position is detected. In addition, the lock protruding portions **175***a* of the lock spring portions **175** and the lock recessed portions **75** formed on the inside surface of the side wall portions **11***e* become disengaged. At this time, the lock protruding portions **175***a* engaging the lock recessed portions **75** are elastically displaced inward in the transverse direction of the card tray **160**.

Because the lock protruding portions **175***a* begin to be deformed when the rear inclined surfaces **75***a***2** come into contact with the rear inclined surfaces **75***a***2** of the lock recessed portions **75** to the rear of the lock protruding portions **175***a*, that is, the rear half, is elastically deformed. Because the lock spring portions **175** include rear corner portions **175***b* formed near the rear end, the rear half is not very flexible (very rigid). Therefore, when the lock protruding portions **175***a* come into contact with the rear inclined surfaces **75***a***2** of the lock recessed portions **75** and begin to be displaced, the rebound force of the spring action of the lock spring portions **175** is great. As a result, the push rod **22** experiences resistance primarily from the spring action of the elastically deformed lock spring portions **175** via the card tray **160** and the ejection lever **21**. However, because the resistance is not as great as the pressing force applied manually by the user, the rod moves forward against the resistance. Also, because the ejection lever **21** functions as a tray ejecting lever, great force can be applied to the card tray **160** in the ejection direction even when the pressing force applied manually by the user is fairly light.

In this way, the rear panel portion **163** of the card tray **160** protrudes sufficiently from the insertion slot **18** of the card connector **1**. This allows the user to grasp the rear panel portion **163** and remove the card tray **160** from the card connector **1**.

In the explanation, the lock spring portions **175** only included front corner portions **175***b***1**. However, if necessary, the lock spring portions **175** can include both front corner

portions **175***b***1** and rear corner portions **175***b***2**, or can include only rear corner portions **175***b***2**.

In the present embodiment, the card tray **160** was able to hold a card **101** including electrode pads and was able to be inserted into a card connector **1**. The card tray **160** included a frame portion **161** opposing the side surfaces **112** of the card **101**, and lock spring portions **175** able to engage and disengage from lock recessed portions **75** on the card connector **1**. The lock spring portions **175** were metal plate springs including only one corner portion **175***b* each and were elastically deformable in the transverse direction of the card tray **160**.

In this way, the spring action of the lock spring portions **175** is improved, and the card tray **160** can be easily inserted into the card connector **1** and held securely inside the card connector **1**. As a result, the card tray **160** is not discharged even when the card connector **1** is subjected to a blow, and external force is applied to the card tray **160** in the release direction from the card connector **1**. Because the amount of elastic deformation by the lock spring portions **175** is great due to the corner portions **175***b*, they are not plastically deformed or damaged. As a result, higher reliability is achieved.

Each lock spring portion **175** is a band-like member secured to the frame portion **161** at both ends and including a main body portion **175***d* extending linearly and an engaging portion **175***a* able to engage a lock recessed portion **75**. Here, a corner portion **175***b* is connected to at least one end of the main body portion **175***d*. Because each lock spring portion **175** is a single unit and has a lock protruding portion **175***a* that can be significantly displaced, they can reliably engage and disengage from the lock recessed portions **75**. This also reduces the manufacturing costs of the lock spring portions **175** and, as a result, lowers the overall manufacturing costs of the card tray **160**.

The corner portions **175***b* are metal plates which are bent from the longitudinal direction of the card tray **160** to a direction intersecting the longitudinal direction. This increases the amount of elastic deformation by the corner portions **175***b* and, as a result, also increases the overall amount of elastic deformation by the lock spring portions **175**.

The lock protruding portions **175***a* include a front inclined surface **175***a***1** and a rear inclined surface **175***a***2** near the apex, and the protruding portions bulge outward in the transverse direction of the card tray **160**. The lock recessed portions **75** include a front inclined surface **75***a***1** and a rear inclined surface **75***a***2**. As a result, the lock protruding portions **175***a* are smoothly displaced when the card tray **160** is inserted into the card connector **1** and ejected from the card connector **1**. In other words, the card connector **160** can be smoothly inserted and ejected.

Also, the corner portions **175***b* are connected only to the front ends of the main body portion **175***d*. The rear ends of the main body portion **175***d* are secured to the frame portion **161**. Because the lock protruding portions **175***a* are flexibly displaced when the card tray **160** is inserted into the card connector **1**, the card connector **160** can be easily inserted. When the card tray **160** is ejected from the card connector **1**, the lock protruding portions **175***a* are not easily displaced and the lock recessed portions **75** are not easily disengaged. As a result, the card tray **160** is reliably held inside the card connector **1**, and the card tray **160** is not discharged even when the card connector **1** is subjected to a blow and external force is applied to the card tray **160** in the release direction from the card connector **1**.

The present disclosure is not limited to the embodiments described above. Variations based on the spirit of the disclosure are possible, and these do not depart from the scope of the present disclosure.

The present disclosure can be applied to a card holding member and a card connector.

The invention claimed is:

1. A card holding member able to hold a card including terminal members and able to be inserted into a card connector, the card holding member comprising:

a frame portion which surrounds all sides of a space serving as a card accommodating space for accommodating the card; and

a movable lock portion arranged in the frame portion which is configured to engage and disengage from a lock portion of a housing of the card connector, the movable lock portion being a spring member made of a metal plate, the movable lock portion being elastically deformable in a width direction of the card holding member, the movable lock portion having an engaging portion which is configured to engage the lock portion of the housing of the card connector, the engaging portion including a front inclined surface and a rear inclined surface formed in front of and behind an apex point.

2. The card holding member according to claim **1**, wherein the engaging portion is a protruding portion bulging outwardly in a transverse direction of the card holding member.

3. The card holding member according to claim **1**, wherein the movable lock portion is a band-like member fixed to the frame portion at both ends and including a main body portion extending linearly, the engaging portion being formed in a middle of the main body portion.

4. The card holding member according to claim **3**, wherein a rear end of the main body portion is secured to the frame portion.

5. A card holding member able to hold a card having terminal members and able to be inserted into a card connector, the card holding member comprising:

a frame portion which surrounds all sides of a space serving as a card accommodating space for accommodating the card, the frame portion having a rear frame portion, a front frame portion and a pair of side frame portions, the rear frame portion and the front frame portion extending parallel to each other in a transverse direction, the side frame portions extending in a longitudinal direction and being connected to ends of the rear and front frame portions, at least one of the side frame portions having a non-metal portion and a metal portion, the metal portion having a movable lock portion, the movable lock portion being elastically deformable in the transverse direction, the movable lock portion having first and second end portions and a main body portion extending linearly between the first and second end portions, the first and second end portions being fixed to the non-metal portion, the movable lock portion having an engaging portion formed in a middle thereof, the engaging portion being configured to engage and disengage from a lock portion of a housing of the card connector, the engaging portion including a front inclined surface and a rear inclined surface formed in front of and behind an apex point; and

a rear panel portion connected to a rear of the rear frame portion.

6. The card holding member according to claim 5, wherein the engaging portion is a protruding portion bulging outwardly in the transverse direction of the card holding member.

7. A combination comprising:

a card connector having a housing having a lock portion; and

a card holding member, the card holding member being configured to hold a card having terminal members and being configured to be inserted into the card connector, the card holding member having a frame portion which surrounds all sides of a space serving as a card accommodating space for accommodating the card, and a movable lock portion arranged in the frame portion which is configured to engage and disengage from the lock portion of the housing of the card connector, the movable lock portion being a spring member made of a metal plate, the movable lock portion being elastically deformable in a width direction of the card holding member, the movable lock portion having an engaging portion which is configured to engage the lock portion of the housing of the card connector, the engaging portion including a front inclined surface and a rear inclined surface formed in front of and behind an apex point.

8. A combination comprising:

a card connector having a housing having a lock portion; and

a card holding member, the card holding member being configured to hold a card having terminal members and being configured to be inserted into the card connector, the card holding member having a frame portion and a rear panel portion, the frame portion surrounding all sides of a space serving as a card accommodating space for accommodating the card, the frame portion having a rear frame portion, a front frame portion and a pair of side frame portions, the rear frame portion and the front frame portion extending parallel to each other in a transverse direction, the side frame portions extending in a longitudinal direction and being connected to ends of the rear and front frame portions, at least one of the side frame portions having a non-metal portion and a metal portion, the metal portion having a movable lock portion, the movable lock portion being elastically deformable in the transverse direction, the movable lock portion having first and second end portions and a main body portion extending linearly between the first and second end portions, the first and second end portions being fixed to the non-metal portion, the main body portion having an engaging portion formed in a middle thereof, the engaging portion being configured to engage and disengage from the lock portion of the housing of the card connector, the engaging portion including a front inclined surface and a rear inclined surface formed in front of and behind an apex point, the rear panel portion connected to a rear of the rear frame portion.

* * * * *